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Status of Atlantic Salmon Stocks  
of Scotia-Fundy Region, 1990

by

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**ABSTRACT**

Catches of 1SW fish relative to the 1984-1989 mean increased 6% in SFA 19, 38% in SFA 20 and 15% in SFA 21, but decreased 69% in SFA 22 and 28% in SFA 23. Released catches of MSW fish relative to the 1984-1989 mean increased 10% in SFA 19, but decreased 37% in SFA 20, 9% in SFA 21, and 85% in SFA 22.

Counting facility and in-river adult counts in all SFAs of Scotia-Fundy Region, 1990, indicate, with one exception, lower returns of wild 1SW and wild MSW salmon than either those of 1989 or the 1984-1989 mean. All wild MSW returns were below forecast numbers.

In four of seven rivers where assessments were possible, the Liscomb (SFA 20), Point Wolfe, Alma and Saint John above Mactaquac (SFA 23), target numbers of spawners were not achieved. Escapement to the Big Salmon River (SFA 23) was substantially below that of 1968-1973, and escapement to the Petitcodiac River (SFA 23) was extremely low.

Forecasts of MSW salmon returning to counting facilities in 1991, relative to 1990 returns, are 23% higher on the Liscomb, SFA 20, 9% higher on the LaHave, SFA 21, and 13% or 27% higher on the Saint John River, SFA 23.

**RÉSUMÉ**

Par rapport à la moyenne de 1984-1989, les prises de saumons unidermarins ont augmenté de 6 % dans la ZPS 19, de 38 % dans la ZPS 20 et de 15 % dans la ZPS 21, mais ont chuté de 69 % dans la ZPS 22 et de 28 % dans la ZPS 23. Par rapport également à cette moyenne, les prises de redibermarins remises à l'eau se sont accrues de 10 % dans la ZPS 19, mais ont diminué de 37 % dans la ZPS 20, de 9 % dans la ZPS 21 et de 85 % dans la ZPS 22.

D'après les dénombrements effectués aux installations de dénombrement et dans les rivières de toutes les ZPS de la région de Scotia-Fundy, les remontées d'unibermarins et de redibermarins sauvages ont été inférieures, à une exception près, à celles de 1989 ou à la moyenne de 1984-1989. De plus, les remontées de redibermarins ont aussi été plus basses que les prévisions.

Dans quatre des sept rivières où on a pu procéder à des évaluations, soit la rivière Liscomb (ZPS 20) ainsi que les rivières Point Wolfe et Alma, et le fleuve Saint-Jean au-dessus du barrage de Mactaquac (ZPS 23), l'effectif cible de géniteurs n'a pas été atteint. Les échappées dans la rivière Big Salmon (ZPS 23) ont été notablement inférieures à celles de 1968-1973. Dans la rivière Petitcodiac (ZPS 23), elles ont été extrêmement basses.

Par rapport aux remontées de 1990, les prévisions de remontées de redibermarins aux installations de dénombrement en 1991 sont à la hausse de 23 % dans la rivière Liscomb (ZPS 20), de 9 % dans la rivière LaHave (ZPS 21) et de 13 ou 27 % dans le fleuve Saint-Jean (ZPS 23).

## INTRODUCTION

This document presents a review, similar to those of 1987 to 1989 (Marshall et al. 1988; Amiro et al. 1989; O'Neil et al. 1989), of the status of Atlantic salmon stocks of the five Salmon Fishing Areas (SFAs 19 to 23) of Scotia-Fundy Region and as such documents sport landings, fishway counts, diver counts and electrofishing results for specific rivers in 1990 and provides, where possible, forecasts of returns in 1991.

## METHODS

Sport fishery data for 1990 in SFAs 19 to 22 (Nova Scotia) were derived from an analysis of Nova Scotia salmon license stubs.

Recreational catches, 1974-1986, for all SFAs of Scotia-Fundy Region appear in the "Redbook" series (DFO, Halifax) and O'Neil et al. (1985; 1986; 1987; 1989). Sport landings for SFAs 19-22, 1974-1983, were adjusted upward to a Nova Scotia license stub equivalency (1984-1990) based on a ratio of (Department of Fisheries and Oceans district officer reports) DFO to license stub comparison in 1983 which indicated that DFO catches were lower. It was assumed that DFO catches for that earlier period were also underestimated.

Catch data for SFA 23 were obtained from New Brunswick Dept. of Natural Resources and Energy field personnel and through creel surveys conducted by the Central Branch, Saint John River Salmon Anglers Association for an area above Mactaquac on the Saint John River and by the Kennebecasis River Salmon Association, on the Kennebecasis River.

Monitoring of upstream migrating wild and hatchery-origin adult salmon is conducted at seven counting facilities in Scotia-Fundy Region: 1) Grand River in SFA 19, 2) Liscomb River in SFA 20, 3) LaHave and 4) Tusket rivers in SFA 21, 5) Petitcodiac, 6) Saint John and 7) St. Croix rivers in SFA 23. Counts of returning hatchery-origin fish from the same fishways and the number of smolts from which they originated are provided as an index of marine survival in 1989-1990.

Estimates of adult salmon populations above the fishway on Grand River (SFA 19) were made by use of counts at the fishway and estimates of fishway by-pass rates (9% for fish <63cm and 43% for larger fish). An estimate of removals by the angling fishery above the Grand River fishway was based on the 1990 sport catch and a 1989 phone-survey that indicated 40% of the 1989 Grand River sport catch occurred above the fishway.

Juvenile densities were determined by electrofishing in the Stewiacke, Salmon and North rivers in SFA 22 and in Big Salmon River in SFA 23. Densities in the Salmon, North and Big Salmon rivers were determined by the removal method from within barriered sites.

Densities of age 1+ and older parr in the Stewiacke River were determined by mark-recapture methods in unbarriered sites. Age-0+ parr densities in the Stewiacke were estimated by dividing the count of the 'mark-run' by the capture efficiency estimated for age-1+ parr.

Forecasts of wild multi-sea-winter (MSW) returns for 1991 were based on regressions of wild MSW counts on wild one sea-winter (1SW) counts of the same smolt class at the Liscomb and LaHave facilities. The MSW run destined to Mactaquac, Saint John River, was forecasted by parametric and nonparametric regression methods from total returns of wild 1SW salmon (and their fork length) destined for Mactaquac in 1990 (Marshall 1991). The 1991 potential run of wild 1SW fish to Mactaquac was estimated using parametric and nonparametric regressions of 1SW returns on egg depositions four and five years previous.

## RESULTS and DISCUSSION

### SFA 19 (Cape Breton East)

Reported effort in the 1990 sport fishery totaled 9,500 rod days or 10% higher than the 1984-1989 mean rod-day effort (Table 1). The 1990 estimated sport catch of 1SW fish is 896 or 6% higher than the 1984-1989 mean. The 1990 estimate of released 1SW fish was 244 or 89% higher than the 1984-1989 mean. An estimated 1,350 MSW salmon were reported released in the 1990 sport fishery which is 10% higher than the 1984-1989 mean.

The count of wild salmon in 1990 at the Grand River fishway, Richmond County, was 269 fish <63cm, and 50 fish ≥63cm (Table 2). The count of wild 1SW salmon was 35% lower than that of 1989; the count of salmon ≥63cm was 52% lower than that of 1989. The 1990 return of 239 hatchery 1SW fish was the first of record on the Grand River. Counts at the fishway are known to underestimate the population above the falls because some fish ascend the falls adjacent to the fishway. Adjustment for by-pass resulted in a population estimate of 296 wild <63cm salmon, 263 hatchery 1SW fish and 89 salmon ≥63cm. Spawning escapement above the falls is unknown due to un-reported removals which occurred above the fishway. Fishery removals below the fishway were estimated at 212 angled salmon <63cm and an additional un-reported number of salmon >63cm. Adjustments for poaching and disease were not made because of the uncertainty in the numbers of fish legally removed.

Age and size distribution of fish obtained during broodstock collections above the fishway, average population numbers and known removals (estimate of 141 sport caught 1SW fish above the fishway) suggest that about 20% of the fish ≥63cm may have been removed. An escapement of 65 fish ≥63cm and 418 fish <63cm above the fishway would have contributed to a deposition of  $1.0 \times 10^6$  eggs or 92% of the requirement for the entire river.

Underwater counts of adult salmon were conducted in four of six sections (Fig. 1) of the Middle River (SFA 19) on October 24, 1990. Section 2,3,4 and 5 counts totalled 69 small salmon thought to be 1SW and 234 large salmon thought to be MSW fish of which 14% were hatchery origin. The estimated total adult fish population, assuming a proportionate distribution similar to that when all sections were included, was 380 adult salmon. Spawning by this number of salmon over the 8,646 units (100 m<sup>2</sup>) of salmon-producing substrate > 0.12% stream gradient would have resulted in reaching 66% of a 2.4 eggs m<sup>-2</sup> target.

An estimated 234 MSW salmon were released from the sport fishery in the Middle River, in 1990 (App. 1). This estimate is high relative to the count conducted after the angling season in the four surveyed sections of the river generally containing higher proportions of the population. In 1989 when 276 fish were released, counts were 60% higher in two of the same sections.

#### **SFA 20 (Eastern Shore)**

The 1990 estimated catch of 1SW fish is 2,995, an increase of 38% from the 1984-1989 mean (Table 1). An estimated 688 MSW salmon were reported released in 1990, a 37% decrease from the 1984-1989 mean.

The 1990 angling catch of 1,914 1SW fish on the St. Mary's River was the highest, and the MSW release of 278 fish was the lowest, of the past five years (App. 1). In the Salmon River (Guysborough), both 1SW and MSW catches were the highest since 1986, but in the Musquodoboit River, the catch of MSW fish was a recent low. Angling catches from most other rivers in SFA 20 were similar to those of 1989 and of the 1984-1989 means (App. 1).

The count of 955 wild 1SW fish at the Liscomb Falls fishway was the second highest of a 12-year record; 80% higher than the 1989 count, but only 28% higher than the 1984-1989 mean of 745 1SW fish (Table 2). The count of 44 wild salmon is the lowest since 1983 but only 38 fish less than the mean value, 1984-1989. The 1SW recreational catch in Liscomb River was 164 fish. The return rate to the fishway of hatchery-origin 1SW fish was 1.56%, (Table 3) which is slightly higher than the mean 1978-1988 value of 1.37%.

For the Liscomb River the equation  $Y = 0.15X - 7.37$  ( $n=8$ ,  $R^2=0.77$ ,  $p < 0.01$ ) was used in 1989 to forecast a return of 72 (90% CL 52-92) MSW salmon in 1990 from the 532 1SW fish counted in 1989. The 1990 count was 44 MSW salmon. An updated equation ( $Y = 0.056X + 23.47$ ;  $n = 11$ ,  $R^2 = 0.31$ ,  $p = 0.045$ ) predicts a return of 54 (90% CL 27-81) MSW salmon in 1991.

Counts of wild (Table 2) and hatchery adults (Table 3) in 1990 were about two thirds of the estimated total river spawning target of 1,908 1SW and 280 MSW fish (Semple and Cameron 1990) for

an estimated  $1.6 \times 10^6$  m<sup>2</sup> of habitat, some of which is adversely affected by acidification.

### **SFA 21 (Southwest N.S.)**

The 1990 estimated catch of 1SW fish in SFA 21 was 3,747 or 7% below the 1989 catch and 15% above the 1984-1989 mean (Table 1). An estimated 949 MSW salmon were reported released, 9% below the 1984-1989 mean.

A count of 1,880 wild 1SW fish at the Morgan Falls fishway, LaHave River, was 94% of the 1984-1988 mean (Table 2). The estimated recreational catch of 1SW fish in the LaHave River was 2,173, 10% less than that of 1989 but 13% greater than the 1984-1989 mean catch (App. 1). The return rate for 1SW fish from  $33.2 \times 10^3$  hatchery smolts stocked above Morgan Falls in 1989 was 1.72%, lowest of the previous four years (Table 3).

A total of 396 wild MSW salmon was counted at Morgan Falls during 1990, which was 79% of the 1984-1989 mean count of 504 MSW salmon (Table 2). The wild MSW count at the fishway was 69% of the 574 MSW salmon predicted by a regression of MSW on 1SW counts. The return rate for 2SW salmon from  $21.4 \times 10^3$  hatchery smolts stocked above Morgan Falls was 0.39% or about 85% of the 1978-1989 average.

The count of wild (Table 2) and hatchery-origin (Table 3) adults at Morgan Falls approximates the average spawner target of 2,815 1SW and 497 MSW fish for the entire river (Cutting et al. 1987) although rearing area above the falls is about 40% of the drainage total.

The regression equation  $Y = 0.20X + 56.40$  ( $n=16$ ,  $R^2=0.65$ ;  $p < 0.001$ ) and the 1,880 1SW fish counted at Morgan Falls during 1990 forecasts a count of 433 (90% CL 362-504) wild MSW salmon in 1991, 86% of the 1984-1989 mean.

A return rate of 0.82% for hatchery 1SW fish on the Tusket River exceeded that of 1989 (0.65%) and the average percent return (0.72%) for which the count was complete (Table 3). The 1990 return rate of 2SW fish was 0.05%, the lowest of record.

### **SFA 22 (Upper Bay of Fundy)**

The catch of salmon <63cm in SFA 22 was 312 fish (Table 1). The number of larger salmon released was 69% below the 1984-1989 mean and 77% below the 1974-1983 mean (Table 1). Stewiacke River yielded 55% of all fish caught within SFA 22 (App. 1). Recreational catches for 24 rivers of the inner Bay of Fundy (Irish River, New Brunswick, to the Cornwallis River, Nova Scotia) have been below average for three of the last five years (Fig. 2).

Mean density of juvenile salmon  $100^{-1}$  m<sup>2</sup> at 31 sites in the Stewiacke River, 1990, was 18.7 for age-0+ parr, 19.3 for age-1+

parr and 3.3 for age-2+ parr. Box plots of parr densities obtained in 1990 compared to those of 1984-1988 indicated no probable differences between years (Fig. 3).

Densities of juvenile salmon from 6 sites in North River, Colchester Co., averaged 33.1 for fish <7.0cm, 11.8 for fish 7.0 - 9.9cm, and 5.9 for fish >9.9cm. Mean densities from six sites in the Salmon River, Colchester Co., averaged 17.0 for fish <7.0cm, 3.5 for fish 7.0 - 9.9cm, and 6.2 for fish >9.9cm.

### **SFA 23 (South Western N.B.)**

Fishing effort (21,915 rod-days) and landings of salmon (2,613 1SW fish) in SFA 23 were down nearly 30% from the five-year mean (Table 1). Fewer than 150 of the harvested salmon came from rivers other than the Saint John and its tributaries (App. 1). A catch of 45 salmon <63cm on the Big Salmon River (an inner Bay of Fundy stock) was 28% of the mean 1984-1989 value; the 59 fish retained on the Magaguadavic River (like the Saint John, an outer Bay of Fundy river) was 148% of the 1984-1989 mean (App. 1).

Counts of salmon obtained on October 18, 1990, by diving in the Big Salmon River after the close of the 1990 angling season, were 64 small and 169 large fish. The counts obtained in 1990 may have been adversely affected by high water and therefore underestimates. The 1990 total count is however, comparable to counts in 1987 and 1988, as low as some counts at the fishway 1954-1962 (mean count 842; range 95-1,767), but lower than counts at the fence 1964-1973 (mean count 2,194; range 678-4,634) (Table 4). It is unlikely that spawning escapement was met for the estimated  $900 \times 10^3$  m<sup>2</sup> of salmon production area.

Sampling of 17 broodstock from the Big Salmon River, October 16, indicated that 6% (1 fish) of the sample was maiden 1SW, 24% was maiden 2SW and 70% was repeat spawners. These proportions differ from a sample of 3,344 fish, 1965-1973, in which 50% was maiden 1SW fish (Jessop 1986). A sample of 46 fish from the 1989 broodstock collection yielded 34 (74%) 1SW fish. Both the broodstock sample and swim-thru counts, in which "grilse" include repeat spawners, suggest that recruitment from the 1989 smolt class was exceptionally low.

Age-1+ parr densities for four of six sites on the Big Salmon River were similar to values obtained in 1989 but lower at two sites than those obtained in 1982 (Table 5).

Diver counts of salmon in the Point Wolfe River for 1990 (conducted by Parks Canada staff) were 37 smaller fish, thought to be maiden 1SW salmon, a decline of 77% from the count of 161 fish obtained in 1989 (Table 6) and 14 large salmon, thought to be repeat spawners, similar to the 1989 count. The escapement in 1990 would not provide as many eggs as that of the target spawner requirement of 139 grilse and 63 salmon set by Parks Canada.

Diver counts of salmon in the Alma River for 1990, (conducted by Parks Canada staff) were 37 smaller fish, thought to be maiden 1SW salmon, a decline of 85% from 250 in 1989, and nine large salmon, thought to be repeat spawners, a decline of 78% from the 41 counted in 1989. The 37 grilse and 9 salmon would not provide as many eggs as that of the target spawner requirement of 60 grilse and 29 salmon set by Parks Canada.

A return of seven salmon to the Petitcodiac River fishway was equal to the lowest count since records began in 1983 (Table 7). Substantial stocking of juvenile fish, including smolts, has contributed few if any fish in 1990 (the origins of fish counted at the fishway were not determined). No adult salmon were found during a sweep of the lower portions of the Pollett and main Petitcodiac rivers with an electroseining boat on November 6, 1990, and no adult salmon were observed in the upper portion of the Pollett or Petitcodiac rivers by divers on the same date.

Counts of salmon at Milltown fishway, St. Croix River, continued to decline in 1990 to only 11% of the wild 1SW and 33% of the wild MSW, 1984-1989, mean counts (Table 1). Return rates of hatchery smolts (Maine Atlantic Sea-Run Salmon Commission) to the Milltown fishway in 1990 were 0.01% for 1SW and 0.05% for 2SW fish. The 1990 return rates are low relative to other counting facilities and stocks (Table 2) and to previous years on the St. Croix.

The count of wild 1SW fish at Mactaquac in 1990 was down from 1989 but only 4% less than the 1984-1989 mean count (Table 2). Estimated returns of wild 1SW fish destined for Mactaquac in 1990 (Marshall 1991) were 98% of the forecast. Return of hatchery 1SW fish originating from smolts released at Mactaquac was 0.40%, the lowest on record (Table 3).

A count of 3,163 wild MSW salmon at Mactaquac in 1990 was down from 1989 and was 73% of the 1984-1989 mean (Table 2). Estimated wild MSW fish destined for Mactaquac was only 58% of the 1989 forecast (Marshall 1991). Spawning requirement above Mactaquac is 4,400 MSW fish. The estimated escapement of 2,875 wild and hatchery MSW spawners is 65% of the requirement.

Forecasts of wild 1SW fish returning to the Saint John River in 1991 and destined to Mactaquac are 6,481 or 7,602 fish (depending on forecast method; Marshall 1991). Forecasts of wild MSW returns to Mactaquac in 1991 are 3,415 MSW fish by parametric regression technique or 3,985 MSW fish by probability density non-parametric regression technique, both similar to the return in 1990. Hatchery-origin 1SW returns are expected to number 3,400 fish, double that of 1990, in part because of extensive stocking by SALEN Inc. above Grand Falls and by the State of Maine in the Aroostook River. Hatchery MSW returns are expected to number 1,262 fish. A total return of either 4,677 or 5,247 MSW salmon in 1991 would result in a potential surplus to spawning escapement of either 277 or 847 salmon. A total return of either 9,881 or 11,002 1SW fish is 13% or 27% greater than the return in 1990.



**SUMMARY/SYNOPSIS**

Catches of 1SW fish relative to the 1984-1989 mean increased 6% in SFA 19, 38% in SFA 20 and 15% in SFA 21, but decreased 69% in SFA 22, and 28% in SFA 23. Released catches of MSW fish relative to the 1984-1989 mean increased 10% in SFA 19, but decreased 37% in SFA 20, 9% in SFA 21, and 85% in SFA 22.

Counting facility and in-river adult counts in all SFAs of Scotia-Fundy Region, 1990, indicate, with one exception, lower returns of wild 1SW and wild MSW salmon than either those of 1989 or the 1984-1989 mean. The exception was the wild 1SW returns to Liscomb Falls (Liscomb River) which was up 80% from 1989 and up 24% from the 1984-1989 mean. All wild MSW returns were below forecast numbers.

Counts by divers and at fishways indicate that minimum target escapements were met above the fishways on the Grand (SFA 19) and LaHave (SFA 21) rivers. Four rivers, the Liscomb (SFA 20), Point Wolfe, Alma, and Saint John above Mactaquac (SFA 23), did not attain the target numbers of spawners. Escapement to the Big Salmon River (SFA 23) was substantially below those of 1968-1973, and escapement to the Petitcodiac River (SFA 23) was extremely low.

The survival of hatchery-reared smolts released in 1989, to 1SW returns at counting facilities was down from 1989 on the Saint John (lowest of record) and LaHave (lowest in five years) but up on both the Liscomb (double that of 1989) and Tusknet rivers. MSW return rates at all fishways were down from 1989. Despite low return rates, hatchery fish contributed about 20% of potential spawning escapement above Mactaquac on the Saint John, 30% above Liscomb Falls on the Liscomb River, 30% above Morgan Falls on the LaHave River and 50% above the Grand River Falls on Grand River.

Forecasts of MSW salmon returning to counting facilities in 1991, relative to 1990 returns, are 23% higher on the Liscomb, SFA 20, 9% higher on the LaHave, SFA 21, and 13% or 27% higher on the Saint John River, SFA 23.

Escapement and catches of 1SW fish in inner Bay of Fundy rivers of SFA 22 and SFA 23 decreased in 1990 relative to 1989. Juvenile densities since 1984 have been stable but 1SW catches in three of the last four years suggest a decline in marine survival of these stocks known to utilize the Bay of Fundy and/or Gulf of Maine area.

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Table 1. Numbers of 1SW salmon and MSW salmon retained and released and effort in the sport fisheries of SFAs 19-23, Scotia Fundy Region, 1974-1990\*.

Year	SFA 19			SFA 20			SFA 21			SFA 22**			SFA 23							
	Catch			Catch			Catch			Catch			Catch							
	1SW	MSW	Effort	1SW	MSW	Effort	1SW	MSW	Effort	1SW	MSW	Effort	1SW	MSW	Effort					
	Ret.	Rel.	in rod-days	Ret.	Rel.	in rod-days	Ret.	Rel.	in rod-days	Ret.	Rel.	in rod-days	Ret.	Rel.	in rod-days					
1974	416	588	7,229	3,462	434	24,977	2,462	397	13,236	2,004	714	7,418	1,312	1,798	16,897					
1975	117	213	2,157	694	94	8,455	1,416	656	8,286	818	293	3,662	1,888	1,691	17,078					
1976	278	445	4,209	2,652	219	18,530	2,474	321	16,026	1,931	537	8,815	3,150	2,498	20,511					
1977	768	561	6,703	1,639	422	14,364	3,434	643	20,278	296	898	9,267	2,040	2,553	22,792					
1978	257	456	10,780	396	272	12,403	460	481	9,748	1,681	334	6,078	843	924	17,128					
1979	281	304	16,761	2,178	267	22,312	2,969	374	14,834	1,258	490	13,030	3,034	927	21,420					
1980	997	795	30,143	3,483	469	25,458	2,773	1,104	25,682	151	526	6,408	2,734	2,860	28,947					
1981	1,265	496	9,365	2,556	581	30,840	4,342	1,284	38,111	1,045	379	6,887	1,963	1,473	30,423					
1982	857	523	18,661	1,657	201	28,187	1,847	494	28,351	983	444	8,717	3,129	2,361	45,520					
1983	240	269	15,322	1,336	401	37,352	471	409	13,743	2,402	386	16,764	2,210	1,103	40,311					
1984	821	108	358	8,759	1,744	128	282	14,426	2,159	232	316	18,868	966	29	257	10,226	2,891	0	28,912	
1985	1,015	0	833	7,749	2,555	0	1,713	17,578	2,790	0	1,567	18,863	1,634	0	578	11,619	4,485	0	38,716	
1986	804	0	1,976	8,901	2,268	0	1,622	20,150	3,110	0	1,583	23,240	830	0	843	11,710	4,033	0	33,555	
1987	890	0	1,390	8,139	1,771	0	686	13,251	4,395	0	799	24,593	255	0	311	6,347	3,870	0	26,870	
1988	873	0	1,580	10,357	2,758	0	1,280	21,434	3,022	0	846	27,222	574	0	175	6,788	2,991	0	26,627	
1989	675	0	1,247	8,081	1,884	0	940	17,908	4,016	0	1,150	27,981	1,755	0	365	10,572	3,590	0	26,354	
1990 ***	896	0	1,350	9,500	2,995	0	688	17,541	3,747	0	949	31,579	312	0	64	5,742	2,613	0	21,915	
Mean																				
1974-83	548	465	12,133	2,005	336	22,288	2,265	616	18,829	1,257	500	8,705	2,230	1,819	26,103					
Mean																				
1984-89	846	1,231	8,664	2,163	1,087	17,458	3,249	1,044	23,461	1,002	422	9,544	3,643	30,172						

\* SFA's 19-22 based on DFO estimates 1974-1983 adjusted by differential between DFO and Nova Scotia license stub returns, 1983; i.e., 1.52, 1.32, 1.36, and 1.04 and license stub returns since 1983. SFA 23 based on DFO estimates.

\*\* SFA 22 data for 1983 are based on Nova Scotia license stub data, not converted DFO figures.

\*\*\* Preliminary.

Table 2. Counts of wild Atlantic salmon from fishway traps in SFAs 19, 20, 21 and 23, Scotia-Fundy Region.

Year	SFA 19		SFA 20		SFA 21		SFA 23			
	Grand		Liscomb		LaHave		Saint John		Saint Croix a.	
	1SW	MSW	1SW	MSW	1SW	MSW	1SW	MSW	1SW	MSW
1974					29	2	3,389	4,775		
1975					38	5	5,725	6,200		
1976					178	23	6,797	5,511		
1977					292	25	3,504	7,247		
1978					275	67	1,584	3,034		
1979			60		856	67	6,234	1,993		
1980			111	0	1,637	288	7,555	8,157		
1981			76	6	1,866	366	4,571	2,441		
1982			252	10	799	256	3,932	2,262	10	51
1983			520	15	1,129	213	3,623	1,712	22	78
1984			606	48	2,043	384	7,353	7,011	166	64
1985			507	87	1,343	638	5,331	6,391	41	264
1986			736	117	1,579	584	6,347	3,656	38	204
1987			1,614	88	2,529	532	5,097	3,088	128	135
1988	553	25	477	76	2,449	386	8,062	1,930	93	190
1989	490	50	532	75	2,084	501	8,417	3,854	79	94
1990	269	50	955	44	1,880	396	6,486	3,163	10	52
Mean (1) to 1983	N/A	N/A	204	8	710	131	4,691	4,333	N/A	N/A
Mean (2) 1984-89	N/A	N/A	745	82	2,005	504	6,768	4,322	91	159
% change										
1990 (1)	N/A	N/A	469%	568%	265%	302%	138%	73%	N/A	N/A
1990 (2)	N/A	N/A	128%	54%	94%	79%	96%	73%	11%	33%

a. wild designation under review

Table 3. Estimated numbers of 1SW and 2SW returns from hatchery-reared smolts released at or above counting facilities on Scotia-Fundy rivers, 1975-1989.

Sea-age	River	Smolts (1000's) Returns	Smolt year														
			1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
1SW	LaHave	Smolts a.				83.9	21.9	61.4	29.0	2.0	19.6	7.2	5.6	23.4	26.9	21.4	33.2
		Ret. (i+1)				1,064	336	1,181	621	27	250	102	135	573	1,056	405	573
		%				1.27	1.54	1.92	2.14	1.32	1.27	1.42	2.42	2.45	3.92	1.89	1.72
	Tusket	Smolts						11.3	29.4	15.8	52.1	10.0	22.6	55.7	30.3	48.1	32.4
		Ret. (i+1)						110	108	102+	41+	51+	71	735	348+	314	267
		%						0.97	0.37	0.64+	0.08+	0.51+	0.31	1.32	1.15+	0.65	0.82
	Liscomb	Smolts				47.4	57.5	26.9	42.4	43.8	58.2	50.0	29.6	19.0	31.3	48.4	28.0
		Ret. (i+1)				485	931	241	827	594	331	175	766	523	431	288	438
		%				1.02	1.61	0.90	1.95	1.35	0.57	0.35	2.59	2.75	1.38	0.60	1.56
	Saint John	Smolts b.	324.2	297.4	293.1	196.2	244.0	232.3	189.1	172.2	144.5	206.5	89.1	191.5	113.4	142.4	238.2
		Ret. (i+1)	9,074	6,992	3,044	3,827	10,793	4,730	2,732	1,337	1,410	1,899	773	3,006	762	1,085	965
		%	2.80	2.35	1.04	1.95	4.42	2.04	1.44	0.78	0.97	0.92	0.87	1.57	0.67	0.76	0.40
MSW	LaHave	Smolts a.				83.9	21.9	61.4	29.0	2.0	19.6	7.2	5.6	23.4	26.9	21.4	
		Ret. (i+2)				385	116	102	64	0	63	49	54	54	164	83	
		%				0.46	0.53	0.17	0.22	0.00	0.32	0.68	0.97	0.23	0.61	0.39	
	Tusket	Smolts						11.3	29.4	15.8	52.1	10.0	22.6	55.7	30.3	48.1	
		Ret. (i+2)						12	16+	6+	17+	8	11	59+	65	22	
		%						0.11	.05+	.04+	.03+	0.08	0.05	0.11+	0.21	0.05	
	Liscomb	Smolts				47.4	57.7	26.9	42.4	43.8	58.2	50.0	29.6	19.0	31.3	48.4	
		Ret. (i+2)				51	49	41	63	42	49	108	54	44	71	22	
		%				0.11	0.08	0.15	0.15	0.10	0.08	0.22	0.18	0.23	0.23	0.05	
	Saint John	Smolts b.	324.2	297.4	293.1	196.2	244.0	232.3	189.1	172.2	144.5	206.5	89.1	191.5	113.4	142.4	
		Ret. (i+2) c.	2,725	2,534	1,188	2,992	2,612	1,531	539	963	799	714	403	678	374	474	
		%	0.84	0.85	0.40	1.52	1.07	0.66	0.28	0.56	0.55	0.35	0.45	0.35	0.33	0.33 *	

a. Estimated "good quality" smolts.

b. Smolts > 12 cm.

c. Incl. some repeat spawners.

+ Potentially higher.

Table 4. Counts of Atlantic salmon at the Big Salmon River fishway, 1954-1962, and counting fence 1964-1972 (Jessop 1986).

Fishway		Fence	
Year	Count	Year	Count
1954	250	1964	1,961
1955	95	1965	3,496
1956	172	1966	4,634
1957	1,682	1967	2,505
1958	1,010	1968	2,531
1959	341	1969	1,274
1960	1,551	1970	1,308
1961	706	1971	678
1962	1,767	1972	1,360
Mean	842	Mean	2,194
High	1,767	High	4,634
Low	95	Low	678

Table 5. Numbers of age-1+ Atlantic salmon parr  $100^{-1} m^2$  as determined at six sites in the Big Salmon River 1982, 1989 and 1990.

Year	Site number						
	2	3	7	9	11	13	15
1982				13.2	25.9	69.7	
1989	4.3	14.4	8.7		10.2	23.3	24.6
1990	2.2	14.8	6.3		12.2	14.7	24.5

Table 6. Number of Atlantic salmon counted by under-water observation in the Point Wolfe and Alma rivers, SFA 23, 1983-1990. \*

Year	Point Wolfe		Alma	
	Grilse	Salmon	Grilse	Salmon
1983	-	-	372	168
1984	-	-	200	183
1985	196	4	276	95
1986	66	29	37	66
1987	36	39	23	29
1988	25	24	33	24
1989	161	17	250	41
1990	37	14	37	9

\* F. Granger, Environment Canada, Fundy National Park, Alma, N.B. Data for 1990 provided by L.Harbish and is maximum of two counts.

Table 7. Number, stage after adsorption of the yoke sac and origin of juvenile Atlantic salmon released, 1980-90 and counts of salmon and grilse at the fishway on the Petitcodiac River 1983-90.

Year	Stage at release							Number tagged	Count at fishway		
	Fry < 2 wk	2 8-14 wk	3 14-20 wk	4 20-26 wk	One yr parr	One yr smolt	Two yr smolt		Grilse	Salmon	Total
1980				90,972 a							
1981											
1982			54,170 d		28,299 b						
1983			224,883 b		31,080 d		18,045 bt	10,000	1,196	15	1,211
1984	29,628 d		269,833 e		17,318 a	8,728 a			331	31	362
1985	11,900 b	38,778 a	249,798 a			20,514 at		3,000	116	32	148
1986		66,822 a	224,249 a			4,000 at		1,732	80	13	93
1987		239,900 b	167,968 b		20,501 f	6,684 at	2,009 bt	3,950	110	6	116
1988	106,486 b		242,997 b		20,338 b	5,662 b	4,016 bt	3,956	7	0	7
1989		40,180 b	189,995 b				5,000 bt		125	11	-136
1990	100,000 b		153,000 b				7,200 b		4	3	7

- a Big Salmon River
- b Saint John River
- c Petitcodiac River
- d Research Center
- e Combination of a+b+c
- t Includes tagged smolt



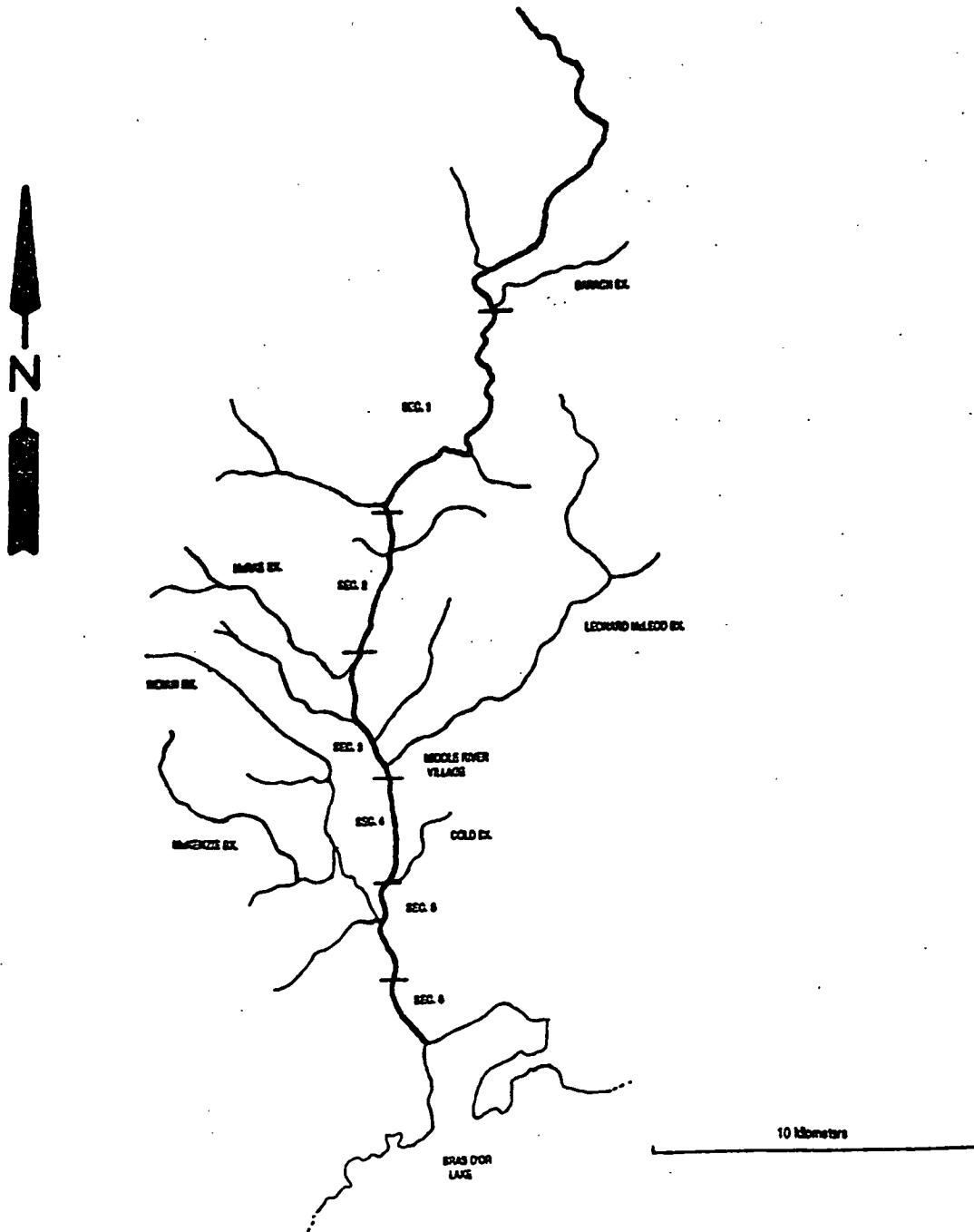


Figure 1. Map of the Middle River, Victoria Co., Nova Scotia, showing six sections of the main river where counts of Atlantic salmon are made by divers.

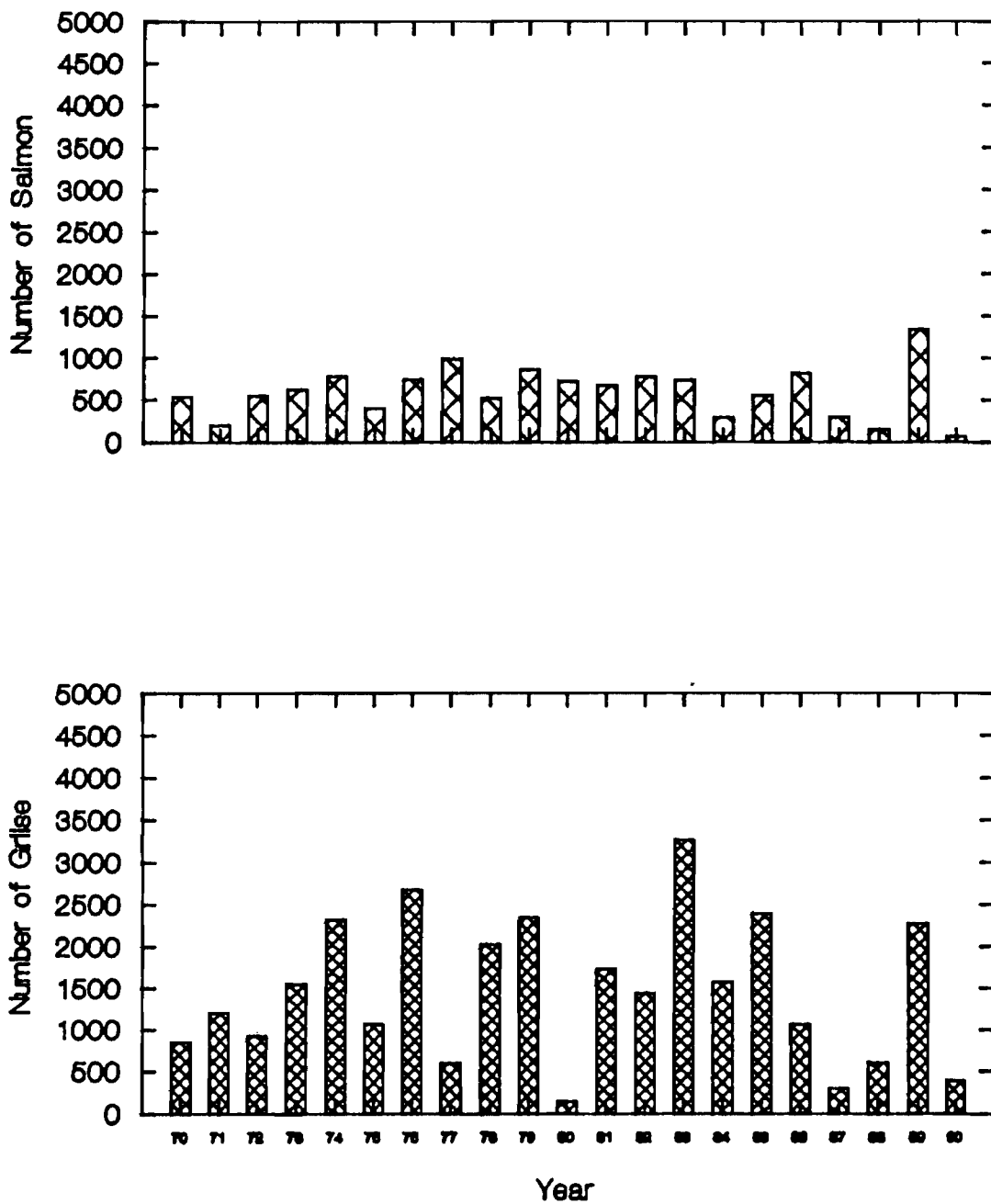


Figure 2. Total recreational catches including releases of Atlantic salmon by size (<63 cm, grilse and  $\geq$ 63cm, salmon) in 24 rivers of the inner Bay of Fundy 1970 - 1990.

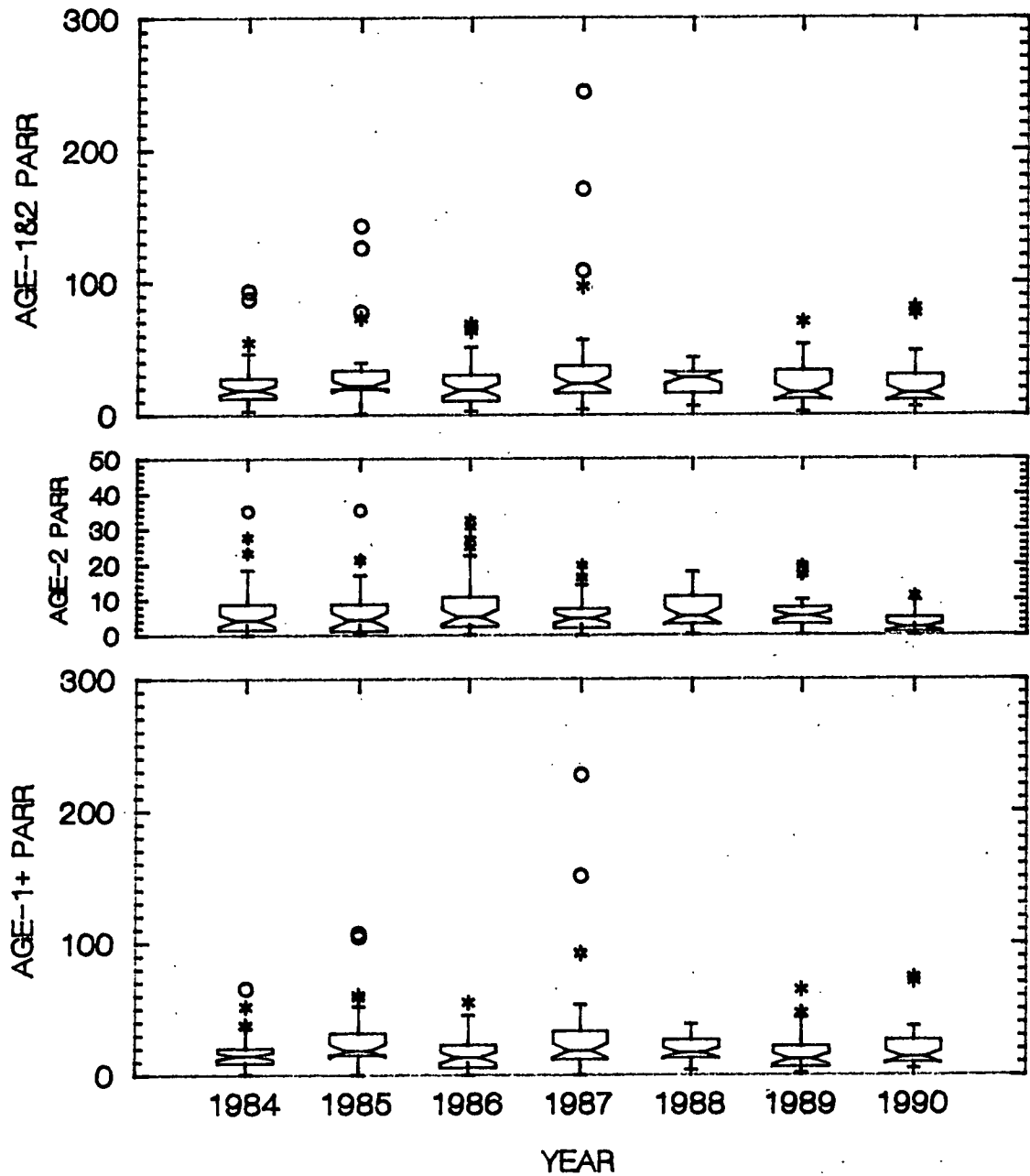


Figure 3. Box plots of median ranks (notches), quartiles (wide and narrow lines, 95% confidence interval outliers of inner (\*) and outer (o) quartiles for age-1+ (lower) age-2+ (middle) and age-1 and 2+ combined Atlantic salmon parr densities (100<sup>-1</sup> m<sup>2</sup>) electrofished in the Stewiacke River 1984 to 1990.

Appendix 1. Atlantic salmon sportcatch and effort for Scotia-Fundy Region rivers for 1990, contrasted with mean catches 1974-83 and 1984-89.\*

River	1990				1984 -89 means				1974 -83 means		
	Grilse		Salmon	Effort	Grilse		Salmon	Effort	Grilse	Salmon	Effort
	retained	released	released		retained	released	released		retained	retained	
<b>Salmon Fishing Area 19</b>											
Aconi Brook	16	2	20	85	4	0	1	44	0	0	5
Baddeck	44	37	179	598	14	8	125	358	4	70	347
Barachois	3	0	15	109	5	2	13	45	0	6	39
Catalone	29	3	15	441	73	8	41	901	0	0	0
Clyburne	0	0	0	3	1	1	5	28	5	9	152
Framboise	28	7	28	450	103	9	45	660	46	32	2921
Gaspereau: Cape Breton Co.	0	0	0	10	1	0	1	22	0	0	0
Gerratt	5	8	0	43	2	2	0	22	0	1	17
Grand	353	63	98	3002	336	44	107	2893	382	56	2967
Indian Brook	2	2	11	46	4	2	11	30	0	3	6
Ingonish	10	0	13	51	4	2	14	45	0	0	19
Inhabitants	44	10	122	562	31	4	144	323	0	0	0
Little Lorraine	0	0	0	0	0	0	0	1	0	0	0
Lorraine Brook	20	2	3	257	30	1	5	230	2	2	69
MacAskill's Brook	2	5	5	36	0	0	0	0	0	0	0
Marie Joseph	16	0	0	95	15	3	5	79	13	8	236
Middle: Victoria Co.	93	33	234	1102	35	9	126	566	30	45	423
Mira	15	0	10	339	9	1	6	144	19	37	3569
North: Victoria Co.	184	70	558	1806	135	30	499	1484	55	194	1886
North Aspy	0	0	11	55	4	1	30	63	0	1	34
Northwest Brook (River Ryan)	2	0	13	51	1	0	0	10	0	0	0
River Bennett	0	0	0	0	0	0	1	2	0	0	0
River Deny's	0	0	0	2	2	0	1	2	0	0	0
River Tillard	21	0	5	75	14	1	22	129	3	8	123
Saint Esprit	2	0	2	17	5	0	2	44	0	0	0
Salmon: Cape Breton Co.	7	2	8	256	22	2	27	531	0	0	0
Skye	0	0	0	0	0	0	0	2	0	0	0
Sydney	0	0	0	9	0	0	3	10	0	0	0
<b>Totals</b>	<b>896</b>	<b>244</b>	<b>1350</b>	<b>9500</b>	<b>846</b>	<b>129</b>	<b>1231</b>	<b>8664</b>	<b>558</b>	<b>472</b>	<b>12814</b>

...cont'd

River	1990				1984 -89 means				1974 -83 means		
	Grilse		Salmon released	Effort	Grilse		Salmon released	Effort	Grilse	Salmon	Effort
	retained	released			retained	released			retained	retained	
<b>Salmon Fishing Area 20</b>											
Clam Harbour	0	0	0	5	0	0	0	0	0	0	0
Cole Harbour	8	2	2	7	0	0	0	2	0	0	0
Country Harbour	36	13	7	225	29	7	10	206	21	14	268
East Sheet Harbour	11	11	0	181	67	12	12	366	0	0	0
Ecum Secum	91	8	7	799	91	7	13	751	106	3	1125
Gaspereau Brook	3	0	0	66	4	1	0	32	31	1	432
Guysborough	3	0	8	26	2	0	1	30	1	6	132
Halfway Brook	0	0	0	0	0	0	0	6	0	0	0
Isaac's Harbour	39	2	2	157	24	1	2	133	28	4	192
Kirby	7	0	0	27	12	1	3	60	27	2	480
Larry's	0	0	0	0	0	0	0	1	0	0	0
Lawrencetown Lake	2	3	2	14	0	0	0	3	0	0	0
Liscomb	164	13	8	763	127	19	16	768	91	5	1262
Little Salmon	0	0	0	9	0	0	2	7	0	0	0
Moser	234	8	20	1321	210	15	23	1292	203	13	3399
Musquodoboit	225	55	99	3256	240	107	240	3398	53	55	1424
Necum Teuch	0	0	0	0	0	1	1	7	0	0	0
New Harbour	116	5	3	654	25	0	2	295	30	15	362
Port Dufferin	20	5	0	172	33	4	3	225	64	3	1009
Porters Lake (East Brook)	0	0	0	0	0	0	0	1	0	0	0
Quoddy	2	0	0	34	3	0	0	25	14	0	319
Rocky Run Porters Lake	0	0	0	3	1	0	0	7	0	0	0
Saint Francis	0	0	0	0	0	0	0	1	0	0	0
Saint Mary's	1583	342	267	6450	895	191	578	6557	1013	159	6076
Salmon: Guysborough Co.	275	31	247	1857	189	14	151	1360	79	35	767
Salmon: Halifax Co.	3	0	0	49	7	2	2	98	0	0	0
Ship Harbour Lake Charlotte	20	0	3	290	42	2	6	434	42	10	465
Tangier	0	0	0	2	0	0	0	8	16	1	307
West Sheet Harbour	153	11	13	1174	162	14	25	1387	186	9	4268
<b>Totals</b>	<b>2995</b>	<b>509</b>	<b>688</b>	<b>17541</b>	<b>2163</b>	<b>396</b>	<b>1087</b>	<b>17458</b>	<b>2005</b>	<b>336</b>	<b>22288</b>

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River	1990				1984 -89 means				1974 -83 means		
	Grilse		Salmon released	Effort	Grilse		Salmon released	Effort	Grilse retained	Salmon retained	Effort
	retained	released			retained	released					
<b>Salmon fishing area 21</b>											
Broad	0	0	0	0	0	0	2	15	0	0	0
Clyde	33	0	0	353	43	12	11	351	0	0	0
East: Lunenburg Co.	0	2	0	7	0	1	0	12	0	0	0
Gold	295	60	78	3186	313	33	108	2374	236	75	1074
Ingram	3	2	0	58	3	2	1	48	4	1	149
LaHave	2173	353	576	15416	1902	254	594	11931	1262	305	11091
Martins	0	0	0	5	0	0	0	3	0	0	0
Medway	630	33	166	6037	566	33	199	4863	556	184	3636
Mersey	145	13	7	2306	59	6	17	1029	14	1	330
Middle: Lunenburg Co	0	3	0	9	4	4	0	30	5	0	46
Mushamush	37	0	0	368	36	3	7	262	0	0	0
Nine Mile	0	0	0	0	0	0	0	4	0	0	0
Petite Riviere	187	11	31	1109	111	12	25	898	123	7	1368
Sackville	34	15	13	283	8	3	2	37	0	0	0
Salmon: Digby Co.	65	7	28	861	61	10	17	554	15	13	573
Tusket	145	7	50	1581	143	15	62	1050	51	29	563
Totals	3747	506	949	31579	3249	389	1044	23461	2265	616	18829

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River	1990				1984 -89 means				1974 -83 means			
	Grilse		Salmon released	Effort	Grilse		Salmon released	Effort	Grilse retained	Salmon retained	Effort	
	retained	released			retained	released						
<b>Salmon Fishing Area 22</b>												
Annapolis	0	0	0	5	2	0	1	38	0	3	151	
Apple	2	2	2	53	9	0	5	73	9	3	46	
Bass	0	0	0	0	0	0	0	1	2	1	29	
Chiganois	0	0	0	19	0	0	0	22	3	1	25	
Cornwallis	2	0	0	68	3	2	3	78	1	2	77	
Debert	5	0	0	109	29	4	12	278	64	31	362	
Diligent	0	0	0	0	0	0	0	1	0	0	0	
East Colchester	3	0	5	24	0	0	0	1	0	0	0	
Economy	0	0	5	39	14	2	5	168	73	33	365	
Folly	7	5	0	90	34	5	10	238	104	51	482	
Gaspereau: Kings Co.	21	10	44	625	32	0	27	473	7	12	417	
Great Village	2	0	0	14	5	1	1	17	4	2	33	
Harrington	0	2	5	22	0	0	0	0	1	0	23	
Kennetcook	0	0	0	3	1	1	1	16	2	1	13	
Maccan	29	11	7	578	80	9	17	828	89	28	474	
Meander (Avon)	0	0	0	0	0	0	0	1	0	0	0	
Nappan	0	0	0	9	0	0	0	2	0	0	0	
Nictaux	0	0	0	0	0	0	0	4	0	1	91	
North : Colchester	13	2	0	193	69	8	11	346	49	29	241	
Portapique	3	3	0	41	9	2	1	45	31	18	225	
Ramshead (Ramsey)	0	0	0	0	0	0	0	1	0	0	0	
River Hebert	7	0	0	101	41	5	7	437	38	4	189	
Round Hill	0	0	0	0	0	0	0	0	0	1	9	
Saint Croix	21	0	0	348	28	5	3	206	15	7	167	
Salmon: Colchester	2	0	0	179	70	18	23	438	46	18	273	
Shubenacadie	24	0	10	252	76	8	32	812	97	41	934	
Stewiacke	171	29	47	2970	501	111	264	5022	622	213	4079	
Totals	312	64	125	5742	1002	180	422	9544	1257	500	8705	

...cont'd

River	1990			1984 -89 means			1974 -83 means				
	Grilse		Salmon released	Effort	Grilse		Salmon released	Effort	Grilse	Salmon	
	retained	released			retained	released			retained	retained	Effort
<b>Salmon fishing area 23</b>											
Alma	4		2	35	19	1		179	79	16	326
Big Salmon	45		U	517	163	U		1,870	413	216	4,610
Canaan	6		U	32	7	U		13	0	0	0
Digdeguash	18		5	95	13	U		90	3	6	55
Hammond	150		U	794	68	U		575	46	74	1,597
Kennebecasis	50		20	200	226	U		2,311	43	59	1,826
Magaguadavic	59		48	477	40	U		409	17	15	186
Nashwaak	196		134	3,155	499	U		3,672	349	583	3,338
Nerepis	10		3	210	54	U		697	0	0	0
St. Croix	7		2	82	15	U		200	10	8	63
Saint John	960		318	6,417	792	U		6,574	592	465	8,157
Salmon: Queens Co.	42		8	264	45	U		202	0	0	0
Salmon: Victoria Co.	500		175	1,400	45	U		264	0	0	0
Tobique	529		U	8,186	1,266	U		11,242	632	364	4,523
Waweig	7		3	51	2	U		36	0	0	0
<b>Totals</b>	<b>2583</b>		<b>718</b>	<b>21915</b>	<b>3254</b>	<b>1</b>		<b>28334</b>	<b>2184</b>	<b>1806</b>	<b>24681</b>

\* 1990 data are preliminary.

\*\* SFA's 19-22 1974-83 means based on DFO estimates adjusted by differential between DFO and Nova Scotia license stub returns, 1983; i.e., 1.52, 1.32, 1.36, and 1.04

U Unknown